IN THE SPECIFICATION

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[0005] The disadvantages associated with the prior art are overcome by the present invention for etching materials with high dielectric constants (high K materials have a dielectric constant greater than 4.0) such as HfO_2, ZrO_2, Al_2O_3, BST, PZK, $ZrSiO_2$, $HFSiO_2$, TaO_2, and the like using a gas mixture comprising a halogen gas and reducing gas. In one embodiment of the invention, an etch gas (or mixture) comprising chlorine (Cl_2) and carbon monoxide (CO) is used for etching [[a]] hafnium-oxide films. In one example, the gas flow rates are in the range 20-300 sccm Cl_2 and about 2-200 sccm CO (i.e., a CL_2/CO flow ratio (0.1-1):(1-0.1)), with a total chamber pressure in the range of 2-100 mTorr.

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[0021] The specific embodiment of the etching process 200 depicted in Fig. 2 comprises the steps of applying bias power to the pedestal (step 204), supplying gas containing chlorine (i.e., Cl_2) to the chamber 100 (step 206), supplying CO to the chamber 100 (step 208), regulating the pressure of the Cl_2 and CO (step 210), applying RF power and forming a plasma (step 212), controlling the wafer temperature (step 214), and etching the ~~silicon~~ hafnium-oxide (step 216). The etching step 216 has a duration that continues until an unmasked portion of hafnium-oxide is removed. The etch time is terminated upon a certain optical emission occurring, upon a particular duration occurring or upon some other indicator determining that the hafnium-oxide has been removed.